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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/579,537	05/16/2006	Walter David Braddock	OSEMDB15UPCTUS	8472

31518 7590 08/21/2008

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EXAMINER	
KIM, JAY C	

ART UNIT	PAPER NUMBER
2815	

NOTIFICATION DATE	DELIVERY MODE
08/21/2008	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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Office Action Summary	Application No.	Applicant(s)	
	10/579,537	BRADDOCK, WALTER DAVID	
	Examiner	Art Unit	
	JAY C. KIM	2815	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *05 June 2008*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1 and 71-92* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1 and 71-92* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *16 May 2006* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

This Office Action is in response to the Amendment filed June 5, 2008.

Specification

1. The amended abstract of the disclosure is objected to because on line 1, "Discloses" should be replaced by "Disclosed". Correction is required. See MPEP § 608.01(b).

2. The disclosure is objected to because of the following informalities:

On line 10 of page 23, "a epitaxial" should be replaced by "an epitaxial".

On line 17 of page 24, "metal-oxide- -compound" should be replaced by "metal-oxide-compound".

Appropriate correction is required.

Claim Objections

3. Claims 80, 87 and 92 are objected to because of the following informalities:

On line 2 of claim 80, "form" should be replaced by "formed".

On line 1 of claim 87, "An" should be replaced by "A".

On lines 1-2 of claim 92, "71." should be removed, and "In2O3" and "Ga2O3" should be replaced by "In_2O_3" and "Ga_2O_3".

Appropriate correction is required.

Claim Rejections - 35 USC § 112

4. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

5. Claim 92 is rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor, at the time the application was filed, had possession of the claimed invention. Applicant discloses that the first layer may be composed of In_2O_3 or Ga_2O_3 (lines 11-15 of page 23 of current Application), and therefore one of ordinary skill in the art would recognize that the first layer comprises In_2O_3 or Ga_2O_3, not both In_2O_3 and Ga_2O_3.

6. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

7. Claim 92 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. It is not clear whether the first layer is a single layer structure comprising a mixture of In_2O_3 and Ga_2O_3, or a multilayer structure comprising In_2O_3 and Ga_2O_3 separately.

Claim Rejections - 35 USC § 103

8. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

9. Claims 1, 71-76 and 81-91 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lucovsky (US 6,552,403) as modified by Lucovsky et al. (US 2002/0024108).

Regarding claims 1, 73 and 74, Lucovsky discloses a metal-oxide-compound semiconductor field effect transistor structure (Fig. 1) comprising a nitride compound semiconductor wafer structure (20) (col. 7, lines 33-34, 47-50, 54-57 and 60-61) having an upper surface (25) (col. 7, line 34), a gate insulator structure (50) (col. 7, lines 39-41), wherein the gate insulator structure (50) may comprise oxygen and indium (col. 3, lines 64-66, and col. 5, lines 2-4), the gate insulator structure (50) in contact with the upper surface (25).

Lucovsky differs from the claimed invention by not showing that the gate insulator structure comprises a first layer and a second layer, wherein the first layer comprises oxygen and indium, the first layer in contact with the upper surface, and wherein the second layer comprises at least one insulating compound (claim 1), wherein the at least one insulating compound comprises at least one of oxygen and sulfur (claim 73), and at least one rare earth element (claim 74).

Lucovsky et al. disclose a gate insulator structure (Fig. 1a) (lines 1-7 of [0076]) comprising a first layer (10) (lines 7-9 of [0077]) and a second layer (20) (lines 2-6 of [0078]), wherein the first layer (10) may comprise oxygen and indium because the first layer (10) may comprise an oxide recited in Lucovsky, and the first layer (10) may be in contact with the upper surface disclosed by Lucovsky, and wherein the second layer (20) comprises at least one insulating compound, which comprises oxygen and may comprise at least one rare earth element of Lanthanum ([0025] and [0032]).

Since both Lucovsky and Lucovsky et al. teach a gate insulator structure of a field effect transistor, it would have been obvious to the one of ordinary skill in the art at the time the invention was made that the metal-oxide-compound semiconductor field effect transistor disclosed by Lucovsky may comprise the gate insulator structure disclosed by Lucovsky et al., because the gate insulator structure disclosed by Lucovsky et al. allows for controlling the nature of the band bending at the compound semiconductor interfaces and surface modification for sensor application (Lucovsky et al., lines 9-14 of [0082]). Further, it has been held that choosing from a finite number of identified, predictable solutions, with a reasonable expectation of success, and use of known technique to improve similar devices (methods, or products) in the same way would be obvious. *KSR International Co. v. Teleflex Inc.* 82 USPQ 2d 1385 (2007).

Regarding claims 71 and 72, Lucovsky et al. further disclose that the at least one insulating compound (20) ([0025], [0027] and [0030]) may comprise indium or gallium, because indium and gallium are Group IIIA elements, and at least one rare earth element of Lanthanum (line 3 of [0032]).

Regarding claims 75 and 76, Lucovsky further comprises for the structure of claim 1 a gate electrode (80) (col. 7, lines 41-42) positioned on the gate insulator structure (50), and source and drain regions (30 and 40, respectively) (col. 7, lines 38-39) self-aligned to the gate electrode (80).

Regarding claim 81, Lucovsky as modified by Lucovsky et al. differ from the claimed invention by not comprising a layer between the first layer and the second layer having a composition intermediate between the compositions of the first layer and the second layer.

It would have been obvious, if not inherent, to the one of ordinary skill in the art at the time the invention was made that an interfacial layer between the first layer and the second layer having a composition intermediate between the compositions of the first layer and the second layer may be formed, because there would be intermixing of elements at the interface between the first layer and the second layer when the first layer and the second layer are formed by one of the techniques disclosed in [0057] of Lucovsky et al. resulting in an interfacial layer between the first layer and the second layer having a composition intermediate between the compositions of the first layer and the second layer.

Regarding claims 82 and 83, Lucovsky as modified by Lucovsky et al. differ from the claimed invention by not showing that the first layer has a thickness of more than 3 angstroms and less than 25 angstroms (claim 82), and the gate insulator structure has a thickness of 10-300 angstroms (claim 83).

The claims are prima facie obvious without showing that the claimed ranges of the thickness achieve unexpected results relative to the prior art range. *In re Woodruff*, 16 USPQ2d 1935, 1937 (Fed. Cir. 1990). See also *In re Huang*, 40 USPQ2d 1685, 1688 (Fed. Cir. 1996) (claimed ranges of a result effective variable, which do not overlap the prior art ranges, are unpatentable unless they produce a new and unexpected result which is different in kind and not merely in degree from the results of the prior art). See also *In re Boesch*, 205 USPQ 215 (CCPA) (discovery of optimum value of result effective variable in known process is ordinarily within skill of art) and *In re Aller*, 105 USPQ 233 (CCPA 1955) (selection of optimum ranges within prior art general conditions is obvious).

Regarding claims 84-86, Lucovsky further discloses for the structure of claim 1 that the upper surface (25) may comprise GaN, $In_xGa_{1-x}N$ or $Al_xGa_{1-x}N$ (col. 7, lines 54-56 and 60-61).

Regarding claim 87, Lucovsky as modified by Lucovsky et al. disclose a field effect transistor (Fig. 1) comprising the structure of claim 1.

Regarding claim 88, Lucovsky further disclose an integrated circuit (col. 7, lines 22-26) that would comprise the structure of claim 1.

Regarding claim 89, Lucovsky discloses a method of making a metal-oxide-compound semiconductor field effect transistor structure (Fig. 1) comprising providing a nitride compound semiconductor wafer structure (20) (col. 7, lines 33-34, 47-50 and 54-57) having an upper surface (25) (col. 7, line 34), and providing a gate insulator structure (50) (col. 7, lines 39-41) comprising oxygen and indium (col. 3, lines 64-66,

and col. 5, lines 2-4), the gate insulator structure (50) in contact with the upper surface (25).

Lucovsky differs from the claimed invention by not showing that the gate insulator structure comprises a first layer and a second layer, wherein the first layer comprises oxygen and indium, the first layer in contact with the upper surface, and wherein the second layer comprises at least one insulating compound.

Lucovsky et al. disclose providing a gate insulator structure (Fig. 1a) (lines 1-7 of [0076]) comprising a first layer (10) (lines 7-9 of [0077]) and a second layer (20) (lines 2-6 of [0078]), wherein the first layer (10) may comprise oxygen and indium because the first layer (10) may comprise an oxide recited in Lucovsky, the first layer (10) may be in contact with the upper surface disclosed by Lucovsky, and wherein the second layer (20) comprises at least one insulating compound.

Since both Lucovsky and Lucovsky et al. teach a gate insulator structure of a field effect transistor, it would have been obvious to the one of ordinary skill in the art at the time the invention was made that the method of making a metal-oxide-compound semiconductor field effect transistor structure disclosed by Lucovsky may comprise providing the gate insulator structure disclosed by Lucovsky et al., because the gate insulator structure disclosed by Lucovsky et al. allows for controlling the nature of the band bending at the compound semiconductor interfaces and surface modification for sensor application (Lucovsky et al., lines 9-14 of [0082]). Further, it has been held that choosing from a finite number of identified, predictable solutions, with a reasonable expectation of success, and use of known technique to improve similar devices

(methods, or products) in the same way would be obvious. *KSR International Co. v. Teleflex Inc.* 82 USPQ 2d 1385 (2007).

Regarding claim 90, Lucovsky discloses a method of making a metal-oxide-compound semiconductor field effect transistor structure (Fig. 1) comprising providing a nitride compound semiconductor wafer structure (20) (col. 7, lines 33-34, 47-50, 54-57 and 60-61) having an upper surface (25) (col. 7, line 34), and depositing a gate insulator structure (50) (col. 7, lines 39-41), wherein the depositing the gate insulator structure (50) may comprise depositing oxygen and indium (col. 3, lines 64-66, and col. 5, lines 2-4 and 46-52) onto the upper surface (25).

Lucovsky differs from the claimed invention by not showing that the depositing a gate insulator structure comprises depositing a first layer and depositing a second layer, wherein the depositing the first layer comprises depositing oxygen and indium, onto the upper surface, and wherein depositing the second layer comprises depositing at least one insulating compound onto the first layer.

Lucovsky et al. disclose depositing a gate insulator structure (Fig. 1a) (lines 1-7 of [0076]) comprising depositing a first layer (10) (lines 7-9 of [0077], and lines 7-15 of [0045]), which may be an oxide recited in Lucovsky, and a second layer (20) (lines 2-6 of [0078]), wherein depositing the second layer (20) comprises depositing at least one insulating compound.

Since both Lucovsky and Lucovsky et al. teach a method of making a gate insulator structure of a field effect transistor, it would have been obvious to the one of ordinary skill in the art at the time the invention was made that the method of making a

metal-oxide-compound semiconductor field effect transistor disclosed by Lucovsky may comprise providing the gate insulator structure disclosed by Lucovsky et al., because the gate insulator structure disclosed by Lucovsky et al. allows for controlling the nature of the band bending at the compound semiconductor interfaces and surface modification for sensor application (Lucovsky et al., lines 9-14 of [0082]). Further, it has been held that choosing from a finite number of identified, predictable solutions, with a reasonable expectation of success, and use of known technique to improve similar devices (methods, or products) in the same way would be obvious. *KSR International Co. v. Teleflex Inc.* 82 USPQ 2d 1385 (2007).

Regarding claim 91, Lucovsky discloses a method of using a metal-oxide-compound semiconductor field effect transistor structure (Fig. 1), the structure (Fig. 1) comprising a nitride compound semiconductor wafer structure (20) (col. 7, lines 33-34, 47-50, 54-57 and 60-61) having an upper surface (25) (col. 7, line 34), and a gate insulator structure (50) (col. 7, lines 39-41), wherein the gate insulator structure (50) may comprise oxygen and indium (col. 3, lines 64-66, and col. 5, lines 2-4), the gate insulator structure (50) in contact with the upper surface (25), and the method comprising inherently applying a voltage to the gate insulator structure (50) to operate the field effect transistor structure (Fig. 1).

Lucovsky differs from the claimed invention by not showing that the gate insulator structure comprises a first layer and a second layer, wherein the first layer comprises oxygen and indium, the first layer in contact with the upper surface, wherein the second layer comprises at least one insulating compound.

Lucovsky et al. disclose a gate insulator structure (Fig. 1a) (lines 1-7 of [0076]) comprising a first layer (10) (lines 7-9 of [0077]) and a second layer (20) (lines 2-6 of [0078]), wherein the first layer (10) may comprise oxygen and indium because the first layer (10) may comprise an oxide recited in Lucovsky, the first layer (10) may be in contact with the upper surface disclosed by Lucovsky, and wherein the second layer (20) comprises at least one insulating compound.

Since both Lucovsky and Lucovsky et al. teach a gate insulator structure of a field effect transistor, it would have been obvious to the one of ordinary skill in the art at the time the invention was made that the metal-oxide-compound semiconductor field effect transistor structure disclosed by Lucovsky may comprise the gate insulator structure disclosed by Lucovsky et al., because the gate insulator structure disclosed by Lucovsky et al. allows for controlling the nature of the band bending at the compound semiconductor interfaces and surface modification for sensor application (Lucovsky et al., lines 9-14 of [0082]). Further, it has been held that choosing from a finite number of identified, predictable solutions, with a reasonable expectation of success, and use of known technique to improve similar devices (methods, or products) in the same way would be obvious. *KSR International Co. v. Teleflex Inc.* 82 USPQ 2d 1385 (2007).

10. Claims 77-80 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lucovsky (US 6,552,403) as modified by Lucovsky et al. (US 2002/0024108) as applied to claim 75 above, and further in view of Kawai et al. (US 5,929,467). The teachings of Lucovsky as modified by Lucovsky et al. are discussed above.

Regarding claim 77, Lucovsky as modified by Lucovsky et al. differ from the claimed invention by not showing that the gate electrode comprises a metal selected from the group of refractory gate metals and combinations thereof.

Kawai et al. disclose a nitride semiconductor field effect transistor (Fig. 1) comprising a gate electrode (7) (col. 4, line 6), which may be formed of molybdenum or tungsten (col. 12, lines 1-2 and 7-9).

Since both Lucovsky and Kawai et al. teach a nitride semiconductor field effect transistor structure, it would have been obvious to the one of ordinary skill in the art at the time the invention was made that the gate electrode disclosed by Lucovsky as modified by Lucovsky et al. may comprise a refractory metal such as molybdenum or tungsten, because molybdenum and tungsten are commonly used as a gate electrode material. Further, it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use. *In re Leshin*, 125 USPQ 416.

Regarding claims 78-80, Lucovsky as modified by Lucovsky et al. differ from the claimed invention by not comprising a substrate (claim 78), wherein the nitride compound semiconductor wafer structure is built on the substrate (claim 79), and the substrate is formed from a member selected from the group consisting of sapphire, silicon, silicon on insulator, aluminum nitride, and gallium nitride (claim 80).

Kawai et al. disclose a nitride semiconductor field effect transistor structure (Fig. 1) comprising a sapphire substrate (1) (col. 3, line 64), wherein a nitride compound

semiconductor wafer structure (composite layer of 2 and 3) (col. 4, lines 10-14) is built on the substrate (1).

Since both Lucovsky and Kawai et al. teach a nitride semiconductor field effect transistor structure, it would have been obvious to the one of ordinary skill in the art at the time the invention was made to combine the metal-oxide-compound semiconductor field effect transistor structure disclosed by Lucovsky as modified by Lucovsky et al. with the sapphire substrate for a GaN wafer structure disclosed by Kawai et al., because a sapphire substrate is commonly used for forming a GaN wafer structure due to its low cost. Further, it has been held that combining prior art elements according to known methods to yield predictable results would be obvious. *KSR International Co. v. Teleflex Inc.* 82 USPQ 2d 1385 (2007).

Response to Arguments

11. Applicant's arguments with respect to claim 1 have been considered but are moot in view of the new grounds of rejection.

Conclusion

12. Applicant's amendment necessitated the new grounds of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to JAY C. KIM whose telephone number is (571)270-1620. The examiner can normally be reached on 7:30 AM - 5:00 PM EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Kenneth Parker can be reached on (571) 272-2298. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Jerome Jackson Jr./
Primary Examiner, Art Unit 2815

/J. K./
Examiner, Art Unit 2815
August 16, 2008